PURPOSE: To evaluate the geometric accuracy of patient set-up in lung cancer radiotherapy using daily megavoltage cone-beam computed tomography (MV-CBCT) image guidance, and compare this with kilovoltage (kV)-CBCT image guidance performed under a similar protocol.
METHODS: Set-up accuracy using MV-CBCT was analyzed in eleven lung cancer patients (246 fractions). The MV-CBCT and CT planning data sets were matched on-line by a radiation oncologist and/or radiation therapist using manual registration of any two independent structures (spinal canal, carina and gross tumour volume) to determine the couch shift required for the correct treatment set-up. For each patient, the couch was adjusted when positional discrepancies exceeded ±2mm in any direction. To estimate the intra-fraction motion, a repeat MV-CBCT was taken after treatment, for the first four treatment fractions. Lung cancer patients to be treated under kV-CBCT image guidance will be recruited in the coming months.
RESULTS: The average systematic error was 4.0mm and 37% of all delivered fractions exceeded significant 3D-positioning errors of 5mm on the initial MV-CBCT. The MV-CBCT demonstrated that initial set-up errors larger than 2mm in any direction occurred in 72% of all fractions. After couch shift to correct the set-up, the average intra-fraction systematic error, including the residual error, was reduced to 2.5mm, and never exceeded 5mm. Errors larger than 2mm, in any direction, were measured for 43% of all delivered fractions on the repeat MV-CBCT. A margin of 5 mm between CTV and PTV was estimated to account for set-up errors including the intra-fraction motion for lung cancer radiotherapy using MV-CBCT image guidance.
CONCLUSION: The analysis indicated that using daily MV-CBCT image guidance in lung cancer patients treated with radiotherapy results in reducing the set-up errors, therefore allowing for reduced PTV margins. This is similar with data reported in literature for lung patients treated under kV-CBCT image guidance.